

# CLAIMS

1. An information reproducing system comprising:  
code reading means for reading a desired dot code  
from an information recording medium on which multimedia  
5 information including at least any one of audio  
information, image information and digital code data has  
been recorded in the form of a dot code which can  
optically be read;

binarizing means for generating binarized data from  
10 an image signal corresponding to the dot code read by  
said code reading means; and

information reproducing means for restoring  
binarized data generated by said binarizing means to  
original multimedia information to reproduce multimedia  
15 information, wherein

said binarizing means includes:

reference dot detection means which binarizes the  
image signal with a predetermined threshold value prior  
to generating binarized data so as to detect a reference  
20 dot from the binarized code image;

dot area measuring means for measuring the area of  
the reference dot detected by said reference dot  
detection means;

threshold value modifying means for modifying the  
25 threshold value in such a manner that the area measured  
by said dot area measuring means approaches a  
predetermined target value; and

threshold value determining means for binarizing the image signal with the threshold value modified by said threshold value modifying means.

5        2. An information reproducing system according to claim 1, wherein said binarizing means binarizes the image signal read by said reading means in one of field and frame units.

10        3. An information reproducing system according to claim 1, wherein  
      said code reading means successively reads the code image, and

15        said binarizing means modifies the threshold value of the successive image signals read by said reading means in one of the previous field and previous frame in accordance with the area of the detected reference dot so as to binarize the one of the present field and present frame with the modified threshold value.

20        4. An information reproducing system according to claim 1, wherein the reference dot is one of a data dot and an insulated dot having substantially the same size and same shape as those of the data dot.

25        5. An information reproducing system according to claim 1, wherein the dot code recorded on said information recording medium includes a data code corresponding to multimedia information and a pattern code for determining the position at which the data code is read, and

the reference dot is at least a portion of the pattern code.

6. An information reproducing system according to claim 5, wherein

5       said dot area measuring means includes:

dot interval measuring means for measuring the distance between predetermined dots forming the pattern code; and

10       area correction means for correcting the area of the reference dot or the target value in accordance with the interval between dots measured by said dot interval measuring means.

7. An information reproducing system according to claim 1, wherein

15       said reference dot detection means detects a plurality of reference dots; and

said dot area measuring means has average area calculating means for calculating the average area of the detected plural reference dots.

20       8. An information reproducing system according to claim 7, wherein

25       said dot area measuring means has dot selection means for inhibiting input of the area of the reference into said average area calculating means in a case where the measured area of each reference dot is larger than a predetermined range.

9. An information reproducing system according to

claim 1, wherein

said threshold value modifying means has threshold value holding means for counting the number of reference dots detected by said reference dot detection means, determines whether or not the counted number of the reference dots satisfies a predetermined number and inhibits modification of the threshold value in a case where the counted number of reference dots is less than the predetermined number.

10. An information reproducing system according to claim 1, wherein

said threshold value modifying means includes; peak value detection means for detecting the maximum value and the minimum value of the luminance from a predetermined detection region;

interior division ratio modifying means for modifying the interior division ratio in accordance with the amount of modification of the interior division ratio calculated from the difference between the area measured by said dot area measuring means and the predetermined target value; and

threshold value calculating means which divides the value detected by said peak value detection means with the interior division ratio modified by said interior division ratio modifying means so as to calculate the threshold value.

11. An information reproducing system according to

claim 10, wherein said peak value detection means interrupts following processes for the image signal for a subject frame in one of a case where detected minimum value is larger than a predetermined first threshold value and a case where the detected maximum value is smaller than a predetermined second threshold value.

12. An information reproducing system according to claim 10, wherein said peak value detection means has selective average calculating means for calculating the absolute value of the difference between pixels adjacent to a pixel of interest and for calculating the average value of the adjacent pixels only when a result of the calculation is smaller than a predetermined threshold value so that the peak values are detected from the average value of the calculated luminance.

13. An information reproducing system according to claim 10, wherein said interior division ratio modifying means has an interior division ratio modification amount table for determining the amount of modification of the interior division ratio in accordance with the relationship between dot area  $S$  and target value  $S_t$  so as to determine amount  $\Delta k$  of modification of the interior division ratio from the measured dot area and the predetermined target value in accordance with said interior division ratio modification amount table.

14. An information reproducing system according to claim 10, wherein said interior division ratio modifying

means calculates the amount  $\Delta k$  of modification of the interior division ratio by using a predetermined coefficient  $\alpha$ , the dot area  $S$  and the target value  $S_t$  in accordance with the following equation:

5            $\Delta K = \alpha(S_t - S).$

15. An information reproducing system according to claim 14, wherein the predetermined coefficient  $\alpha$  is made to be one of the same and smaller whenever modification is repeated.

10           16. An information reproducing system according to claim 10, wherein said interior division ratio modifying means changes the interior division ratio in a stepped manner and provides a hysteresis characteristic.

15           17. An information reproducing system according to claim 10, wherein said interior division ratio modifying means has interior division ratio limit means which determines whether or not the modified interior division ratio is in a predetermined range to clip the interior division ratio in a case where the interior division  
20           ratio is out of the predetermined range.

18. An information reproducing system according to claim 10, wherein

          said reference dot detection means detects a plurality of reference dots, and

25           said interior division ratio modifying means has interior division ratio holding means for counting the number of the detected reference dots, for determining

whether or not the counted number satisfies a predetermined number and for inhibiting modification of the interior division ratio in a case where the counted number does not satisfy the predetermined number.

5           19. An information reproducing system according to claim 10, wherein

          said reading means successively reads the code images,

10           said interior division ratio modifying means modifies the interior division ratio to one of a field and a frame which satisfies a predetermined condition for the successive image signals read by said reading means and holds the modified interior division ratio for one of the following field and frame.

15           20. An information reproducing system according to claim 1, wherein

          the dot code recorded on said information recording medium has an attitude dot disposed in a predetermined region adjacent to the reading start end and including  
20           information about said information recording medium for determining the threshold value required by said binarizing means,

          said binarizing means includes:

25           attitude dot detection means for detecting the attitude dot;

          attitude reading means which binarizes the image signals read by said reading means in one of field and

frame units so as to read information relating said information recording medium from the attitude dot of said binarized image detected by said attitude dot detection means; and

5 attitude storage means for storing information read by said attitude reading means and applying information to each of following images.

21. An information reproducing system comprising:

10 code reading means for reading a desired dot code from an information recording medium on which multimedia information including at least any one of audio information, image information and digital code data has been recorded in the form of a dot code which can optically be read;

15 binarizing means for generating binarized data from an image signal corresponding to the dot code read by said code reading means; and

20 information reproducing means for restoring binarized data generated by said binarizing means to original multimedia information to reproduce multimedia information, wherein

said binarizing means includes:

region dividing means for dividing the picked up screen of the dot code into a plurality of regions;

25 characteristic amount extracting means for extracting the characteristic amount for binarization in region units divided by said region dividing means;

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threshold value calculating means for calculating the threshold value for binarization in accordance with the characteristic amount extracted by said characteristic amount extracting means; and

5 threshold value determining means for binarizing the image signal with the threshold value calculated by said threshold value calculating means.

*2 22*. An information reproducing system according to claim *21*, wherein

10 said information recording medium has a reference region for extracting the characteristic amount, and

said region dividing means divides the region in such a manner that the divided region includes at least one reference region.

15 *23*.<sup>3</sup> An information reproducing system according to claim *22*,<sup>2</sup> wherein

said reference region is at least one of a marker and an inhibition region adjacent to said marker, and

20 said characteristic amount extracting means extracts the characteristic amount from the region.

*24*.<sup>4</sup> An information reproducing system according to claim *21*, wherein said characteristic amount extracting means extracts the maximum value of the luminance in each of the divided regions.


25 *25*.<sup>5</sup> An information reproducing system according to claim *24*,<sup>4</sup> wherein said characteristic amount extract means has maximum value averaging means which extracts

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the maximum value of the luminance in each of the divided regions and which averages the extracted maximum value in at least two or more adjacent fields or frames in terms of time.

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~~26~~<sup>6</sup> An information reproducing system according to claim ~~21~~<sup>1</sup>, wherein

  
said characteristic amount extracting means extracts the maximum value of the luminance of each of the divided regions as a first characteristic amount and extracts the minimum value of the luminance of the overall screen as a second characteristic amount, and

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said threshold value calculating means calculates the threshold value for each region from the maximum value and the minimum value of the luminance in accordance with a predetermined interior division ratio.

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~~21~~<sup>7</sup> An information reproducing system according to claim ~~26~~<sup>6</sup>, wherein

said reading means continuously read the code images, and

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the minimum value of the luminance is extracted from one of the previous field and frame.

~~28~~<sup>8</sup> An information reproducing system according to claim ~~26~~<sup>6</sup>, wherein said characteristic amount extract means has maximum value averaging means which extracts the maximum value of the luminance in each of the divided regions and which averages the extracted maximum value in at least two or more adjacent fields or frames

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in terms of time.

29.9 An information reproducing system comprising:

code reading means for reading a desired dot code  
from an information recording medium on which multimedia  
5 information including at least any one of audio  
information, image information and digital code data has  
been recorded in the form of a dot code which can  
optically be read;

binarizing means for generating binarized data from  
an image signal corresponding to the dot code read by  
said code reading means; and

information reproducing means for restoring  
binarized data generated by said binarizing means to  
original multimedia information to reproduce multimedia  
15 information, wherein

said binarizing means includes:

peak value detection means for detecting the  
maximum value and the minimum value of the luminance  
from a predetermined detection region;

20 code detection means for detecting whether or not  
a code exists in said detection region;

minimum value replacing means for replacing the  
minimum value in the detection region with the minimum  
value of one of the previous field and frame in a case  
25 where said code detection means does not detect a code;  
and

threshold value calculating means for calculating

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the threshold value for binarization for the same region of one of a next field and a next frame from the detected maximum value and the detected or replaced minimum value in accordance with a predetermined interior division ratio.

30.<sup>10</sup> An information reproducing system according to claim 29,<sup>9</sup> wherein said code detection means has peak ratio determining means for determining whether or not the ratio of peak values detected by said peak value detection means is larger than a predetermined value.

31.<sup>11</sup> An information reproducing system comprising:  
code reading means for reading a desired dot code from an information recording medium on which multimedia information including at least any one of audio information, image information and digital code data has been recorded in the form of a dot code which can optically be read;

binarizing means for generating binarized data from an image signal corresponding to the dot code read by said code reading means; and

information reproducing means for restoring binarized data generated by said binarizing means to original multimedia information to reproduce multimedia information, wherein

said binarizing means includes:

peak value detection means for detecting the maximum value and the minimum value of the luminance

from a predetermined detection region;

code detection means for detecting whether or not a code exists in said detection region;

5 minimum value replacing means for replacing the minimum value in the detection region with the minimum value of the adjacent detection region in a case where said code detection means does not detect a code; and

10 threshold value calculating means for calculating the threshold value for binarization for the same region of one of a next field and a next frame from the detected maximum value and the detected or replaced minimum value in accordance with a predetermined interior division ratio.

15 <sup>12</sup>32. An information reproducing system according to claim <sup>11</sup>31, wherein said code detection means has peak ratio determining means for determining whether or not the ratio of peak values detected by said peak value detection means is larger than a predetermined value.

20 33. An information recording medium for use in an information reproducing system having code reading means for reading a desired dot code from an information recording medium on which multimedia information including at least any one of audio information, image information and digital code data has been recorded in  
25 the form of a dot code which can optically be read; binarizing means for generating binarized data from an image signal corresponding to the dot code read by said

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code reading means; and information reproducing means for restoring binarized data generated by said binarizing means to original multimedia information to reproduce multimedia information, said information recording medium comprising:

data dots which correspond to the contents of multimedia information and which can optically be read; and

a reference dot arranged to be detected by said binarizing means and serving as a reference when the threshold value is modified to allow the area of the detected dot to approach a predetermined target value.

34. An information recording medium according to claim 33, wherein a plurality of the reference dots are recorded in an image pickup region.

35. An information recording medium according to claim 33, wherein said information recording medium has dot interval measuring dots for measuring a dot interval for correcting at least one of the area of the reference dot detected by said binarizing means and the predetermined target value.

36. An information recording medium for use in an information reproducing system having code reading means for reading a desired dot code from an information recording medium on which multimedia information including at least any one of audio information, image information and digital code data has been recorded in

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the form of a dot code which can optically be read;  
binarizing means for generating binarized data from an  
image signal corresponding to the dot code read by said  
code reading means; and information reproducing means  
for restoring binarized data generated by said  
binarizing means to original multimedia information to  
reproduce multimedia information, said information  
recording medium comprising:

data dots which correspond to the contents of  
multimedia information and which can optically be read;  
and

a reference dot serving as a reference when said  
binarizing means detects the maximum value and the  
minimum value of the image signal level corresponding to  
the dot code, detects a dot from a code data binarized  
by a threshold value calculated from the maximum value  
and the minimum value in accordance with a predetermined  
interior division ratio and modifies the interior  
division ratio in such a manner that area of the  
detected dot approaches a predetermined target value.

37. <sup>14</sup> An information recording medium according to  
claim 36, <sup>13</sup> wherein a plurality of the reference dots are  
recorded in an image pickup region.

38. <sup>15</sup> An information recording medium according to  
claim 36, <sup>13</sup> wherein said information recording medium has  
a reference region for use when said binarizing means  
extracts the characteristic amount for binarization.

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39. An information recording medium according to  
claim 36,<sup>13</sup> wherein said information recording medium has  
dot interval measuring dots for measuring a dot interval  
for correcting at least one of the area of the reference  
dot detected by said binarizing means and the pre-  
determined target value.

40.<sup>17</sup> An information recording apparatus for  
recording multimedia information including at least any  
one of audio information, image information and digital  
code data in the form of a dot code which can optically  
be read, comprising:

reference dot recording means for recording at  
least two types of reference dots having at least  
different areas of shapes;

reference dot reading means for reading the  
reference dots recorded by said reference dot recording  
means to binarize the read reference dots;

reference dot selection means for subjecting the  
area of each reference dot read by said reference dot  
reading means and a predetermined reference value to a  
comparison to select a reference dot having the  
different smaller than a predetermined threshold value;  
and

recording means for recording a dot code  
corresponding to multimedia information in accordance  
with the reference dot selected by said reference dot  
selection means.

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41.<sup>18</sup> An information recording apparatus according to claim 40,<sup>17</sup> wherein at least two or more types of said reference dots are recorded in such a manner that at least one of the area and the shape is different at each of predetermined steps of a minimum resolving power of said information recording apparatus.

42.<sup>19</sup> An information recording apparatus for recording multimedia information including at least any one of audio information, image information and digital code data in the form of a dot code which can optically be read, comprising:

reference dot recording means for recording reference dots having different recording densities;

reference dot reading means for reading the reference dots recorded by said reference dot recording means to binarize the read reference dots;

recording density adjustment means for subjecting the area of each of the reference dots read by said reference dot reading means and a predetermined reference value to a comparison to adjust the recording density in such a manner that the difference is smaller than a predetermined threshold value; and

recording means for recording a dot code corresponding to multimedia information in accordance with the recording density adjusted by said recording density adjustment means.

43.<sup>20</sup> An information recording apparatus for

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recording multimedia information including at least any one of audio information, image information and digital code data in the form of a dot code which can optically be read, comprising:

5 reference dot recording means for recording at least two or more types of reference dots having different recording densities;

reference dot reading means for dividing a picked up screen in such a manner that only one reference dot recorded by said reference dot recording means is included in a divided region and binarizing each divided region to read the reference dot to binarize the reference dot;

10 density selection means for subjecting the area of each reference dot read by said reference dot reading means and a predetermined reference value to a comparison and for selecting the density of the reference dot having the difference smaller than a predetermined threshold value; and

20 recording means for recording a dot code corresponding to multimedia information in accordance with the recording density selected by said density selection means.

25 44. An information recording apparatus for recording multimedia information including at least any one of audio information, image information and digital code data in the form of a dot code which can optically

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be read, comprising:

input means for inputting information relating to  
said information recording medium;

5 storage means for storing the relationship between  
information relating to a predetermined information  
recording medium and one of the area of the dot when  
data is recorded and the recording density; and

10 means for reading corresponding one of the dot area  
and the recording density from said storage means in  
accordance with information input by said input means  
and relating to said information recording medium so as  
to record a dot code corresponding to multimedia  
information in accordance with the one of the dot area  
and the recording density.

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